Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

May 23, 2016

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NPF-90
NRC Docket No. 50-390

Subject: **Licensee Event Report 390/2016-004-00, Automatic Reactor Trip Due to Actuation of Over Temperature Delta Temperature Bistables**

This submittal provides Licensee Event Report (LER) 390/2016-004-00. This LER provides details concerning a recent automatic plant trip on Over Temperature Delta Temperature. This report is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A).

Please direct any questions concerning this matter to Gordon Arent, WBN Licensing Director, at (423) 365-2004.

Respectfully,

Paul Simmons
Site Vice President
Watts Bar Nuclear Plant

Enclosure
cc: See Page 2

cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant

NRC FORM 366 (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Watts Bar Nuclear Plant, Unit 1	05000390	1 OF 4

4. TITLE

Automatic Reactor Trip Due to Actuation of Over Temperature Delta Temperature Bistables

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	N/A
03	22	2016	2016	004	00	05	23	2016	FACILITY NAME N/A	DOCKET NUMBER N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
100	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Dean Baker, Licensing Engineer	423-452-4589

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	TG	Card	SIEMENS	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On March 22, 2016, at 1131 Eastern Daylight Time, the Watts Bar Nuclear Plant Unit 1 (WBN1) reactor tripped due to the actuation of the Over Temperature Delta Temperature bistables. Concurrent with the reactor trip, the Auxiliary Feedwater system actuated. All control rods inserted upon the reactor trip and safety systems functioned as expected.

An investigation into the cause of the trip determined that a failure of a Valve Position Limit up/down counter circuit card in the Analog Electro-Hydraulic Turbine Control System resulted in the closure of the turbine high pressure governor valves, resulting in an automatic reactor trip and turbine trip on WBN1. The failed card was replaced and WBN Unit 1 was returned to service.

This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv)(A).

NRC FORM 366A (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Watts Bar Nuclear Plant, Unit 1	05000390	2016	- 004	- 00

NARRATIVE

I. PLANT OPERATING CONDITIONS BEFORE THE EVENT

Watts Bar Nuclear Plant (WBN) Unit 1 was in Mode 1 at 100 percent rated thermal power (RTP).

II. DESCRIPTION OF EVENT

A. Event

On March 22, 2016, at 1131 Eastern Daylight Time (EDT), the Watts Bar Nuclear Plant Unit 1 (WBN1) reactor tripped due to the actuation of the Over Temperature Delta Temperature bistables. Concurrent with the reactor trip, the Auxiliary Feedwater (AFW) system actuated. All control rods inserted upon the reactor trip and safety systems functioned as expected.

An investigation into the cause of the trip determined that a failure of a Valve Position Limit (VPL) up/down circuit card {EIIS:CBD} in the Analog Electro-Hydraulic (AEH) turbine controls {EIIS:TG} resulted the closure of the turbine high pressure governor valves {EIIS:XCV}, resulting in an automatic reactor trip and subsequent turbine trip on WBN1. The failed card was replaced and WBN Unit 1 was returned to service.

This event was reported to the Nuclear Regulatory Commission (NRC) on March 22, 2016 via Event Notification 51815 pursuant to 10 CFR 50.72(b)(2)(iv)(B) and 10 CFR 50.72(b)(3)(iv)(A).

B. Inoperable Structures, Components, or Systems that Contributed to the Event

A DC to DC converter failed on the VPL Up/Down counter card in the AEH controls, which resulted in the plant trip.

C. Dates and Approximate Times of Occurrences

On March 22, 2016, the main turbine control system VPL Up/Down circuit card failed, which resulted in the four main turbine governor valves going closed. Eight seconds after valve closure the reactor tripped on over temperature delta temperature.

D. Manufacturer and Model Number of Components that Failed

The up/down counter circuit card was supplied by Siemens, Part number 1B51049-101.

E. Other Systems or Secondary Functions Affected

The failure of the Valve Position Limiter did not directly affect the function of any other systems or other secondary functions.

F. Method of discovery of each Component or System Failure or Procedural Error

The component failure was discovered by performance of the maintenance procedure that checks/calibrates the main turbine control system. This was only a component failure, no system failures or procedural errors caused this event.

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NARRATIVE

G. Failure Mode and Effect of Each Failed Component

The VPL circuit card's output failed to zero percent, which as designed, caused the main turbine control system to limit the position of the four governor valve to zero percent. This constitutes a complete loss of external electrical load.

H. Operator Actions

This was an uncomplicated reactor trip. No special operator actions were required.

I. Automatically and Manually Initiated Safety System Responses

All automatic and manual safety systems responded as expected.

III. CAUSE OF THE EVENT

A. The cause of each component or system failure or personnel error, if known.

A DC to DC converter failed on the VPL Up/Down counter card in the AEH controls, which caused the card's output to fail to zero percent.

B. The cause(s) and circumstances for each human performance related root cause.

There were no human performance causes associated with this plant trip.

IV. ANALYSIS OF THE EVENT

On March 22, 2016 at 1131 EDT, the main turbine control system VPL circuit card failed. This failure caused all four main turbine governor valve to go fully closed. This constituted a complete loss of external electrical load for the unit. The reactor continued to operate for approximately 8 seconds after the governor valves closed until the reactor protection system tripped the reactor on over temperature delta temperature. All safety systems operated as expected, and operations personnel were able to promptly stabilize the plant in Mode 3.

V. ASSESSMENT OF SAFETY CONSEQUENCES

A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event

The turbine controls system is not safety related. The failure of the VPL Up/Down card resulted in a plant trip, but otherwise did not impact any plant safety functions .

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident

Not applicable.

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C. For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from the discovery of the failure until the train was returned to service

Not applicable.

VI. CORRECTIVE ACTIONS

This event was entered into the Tennessee Valley Authority Corrective Action Program and is being tracked under condition report 1152462.

A. Immediate Corrective Actions

The failed VPL Up/Down card that resulted in the plant trip was replaced.

B. Corrective Actions to Prevent Recurrence

The existing turbine control system has a number of identified single point vulnerabilities. The long term plan is to replace the existing AEH turbine control system with a modern fault tolerant turbine digital control system.

VII. ADDITIONAL INFORMATION

A. Previous similar events at the same plant

On May 21, 2010, WBN Unit 1 experienced a reactor trip on turbine trip from full 100 percent rated thermal power caused by closure of the Main Turbine Throttle/Stop valves as reported in LER 2010-001 dated July 20, 2010. The probable cause was determined to be an intermittent failure of a circuit card in the AEH turbine control system. The existing AEH circuit cards that were in the signal path that resulted in the trip were replaced.

B. Additional Information

None.

C. Safety System Functional Failure Consideration

This condition did not result in a safety system functional failure.

D. Scrams with Complications Consideration

There were no complications as a result of this reactor trip.

VIII. COMMITMENTS

None.